Capricorn FLX™ Weather Station

User Manual

Columbia
Weather Systems

Capricorn FLX™ Weather Station

User Manual

Version 1.22

Serial Number: _____

Date Purchased: _____

All specifications subject to change without notice.

Printed in U. S. A.

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Welcome!

Congratulations on your purchase of the Capricorn FLX Weather Station.

The Capricorn FLX is a precision instrument that requires proper installation and a certain amount of regular maintenance.

Please read this manual completely prior to installation.

Important Notice: Shipping Damage

BEFORE YOU READ ANY FURTHER, please inspect all system components for obvious shipping damage. The Capricorn FLX is a high precision instrument and can be damaged by rough handling. Your unit was packaged to minimize the possibility of damage in transit. Therefore, we recommend that you save the shipping container for any future shipment of your Capricorn unit.

In the event your order arrives in damaged condition, it is important that the following steps be taken immediately. The title transfers automatically to you, the customer, once the material is entrusted to the transport company.

NOTE: DO NOT RETURN THE INSTRUMENT TO COLUMBIA WEATHER SYSTEMS until the following steps are completed. Failure to follow this request will jeopardize your claim.

1. Open the container and inspect the contents. Do not throw away the container or any damaged parts. Try to keep items in the same condition as originally received.
2. Notify the transport company immediately in writing, preferably by facsimile, about the shipping damage.
3. Wait for the transport company's representative to inspect the shipment personally.
4. After inspection, request authorization from Columbia Weather Systems for return of the damaged instrument by calling (503) 629-0887.
5. Return approved items to us at the following address:

   Columbia Weather Systems, Inc.

   5285 NE Elam Young Parkway, Suite C100

   Hillsboro, OR 97124

6. After return authorization is issued and we receive the instrument, an estimate of the cost of repair will be sent to you for submittal to the transport company as a claim.

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SECTION 1: INTRODUCTION

The Capricorn FLX System

Designed around a Control Module that is housed in a compact, utility-grade enclosure. The Capricorn FLX offers serial communication over RS-232 or RS-485 to various monitoring options.

Features include:

- Modular design for sensor selection and optimal sensor location
- Proven, reliable mechanical wind sensors
- Temperature and/or humidity in self-aspirating radiation shield
- Many other meteorological sensor options
- Two additional general-purpose analog channels
- Low power consumption
- One-year warranty

Technical Specifications

Temperature

Up to four temperature sensors can be connected to the Capricorn FLX.

Type: Digital Semiconductor

Range: -67° to 257°F

Accuracy: ± 0.9°F from +14° to 185°F (±0.5°C from -10° to 85°C)
± 3.6°F from -67° to 257°F (±2.0°C from -55° to 125°C)

Resolution: 0.01°F

Cable Length: maximum 400 ft.

Barometric Pressure

The board mount precision barometric pressure sensor provides accurate pressure data with full temperature compensation. The sensor outputs are digitized by a high resolution 24-bit analog to digital converter.

Type: Digital Semiconductor

Range: 14.8 to 32.5 inHg (500 to 1100 hPa)

Accuracy: ±0.03 in. Hg (1 hPa)

Resolution: 0.001 in. Hg (0.03 hPa)

Wind Speed

Type: Sealed Reed Switch

Accuracy: ± 0.25 mph from 0 to 23 mph, ± 1% from 24 to 160 mph

Range: 0 to 160 mph (139 knots)

Resolution: 1 mph

Starting Threshold: 0.9 mph

Wind Direction

Type: Precision Potentiometer

Resolution: 2 degrees

Mechanical Range: 0 to 360 degrees

Electrical Range: 0 to 356 degrees

Accuracy: ± 4 degrees

Resolution: 1°

Relative Humidity

Type: Capacitance

Range: 0 to 100%RH

Accuracy:

From 0 to +40 °C:

0 - 90 %RH: ±3 %RH

90 - 100 %RH: ±5 %RH

From -40 to 0 °C and +40 to +60 °C:

0 - 90 %RH ±5 %RH

90 - 100 %RH ±7 %RH

Stability: ±2% RH over 2 years

Resolution: 1% RH

Rainfall

Type: Tipping Bucket

Accuracy: ±1% at 2 in/hr or less

Resolution: 0.01 inch

Solar Radiation Sensor (Pyranometer)

Type: High Performance Silicon Photodiode

Cosine Response: ± 2% at 45° zenith angle, ± 5% at zenith angle 75°

Calibration Uncertainty: ± 5%

Measurement Repeatability: < 1 %

Non-linearity: < 1 % (maximum radiation measurement is 1250 W/m-2

Field of View: 180°

Sensitivity: Custom calibrated to exactly 5.00 W/m-2 per mV

Operating Environment: -40 to 70℃, 0 to 100% relative humidity

Power Supply

Powered by a wall mount transformer

Input: 120 VAC, 60 HZ, 16 W

Output: 12 VDC, 2.08 A

Control Module

Input Voltage: 8 – 24VDC

Current Consumption: 10mA @ 12VDC

Dimensions: 5.8" L x 4.5" W x 2.4" H

Weight: 0.4lbs

SECTION 2: PHYSICAL DESCRIPTION

Capricorn FLX
Control Module
Columbia
Weather Systems
www.columbiaweather.com
Serial Output
Solar 1 | RH | WD | WS | Rain | Temp 1
Power
9-24 VDC
Solar 2 | A1 | A2 | Temp 2 | Temp 3 | Temp 4

Control Module

The Control Module consists of a System board housed in a light grey 3mm ABS plastic enclosure with a tongue-and-groove cover.

The front panel of the Control Module includes 12 terminal blocks for sensor connections, a serial communication port, a grounding lug and a power input connection.

The System board includes a board mount Barometric Pressure Sensor.

During operation the Yellow LED next to the power input remains solid and the Red LED next to the terminal blocks blinks once per second.

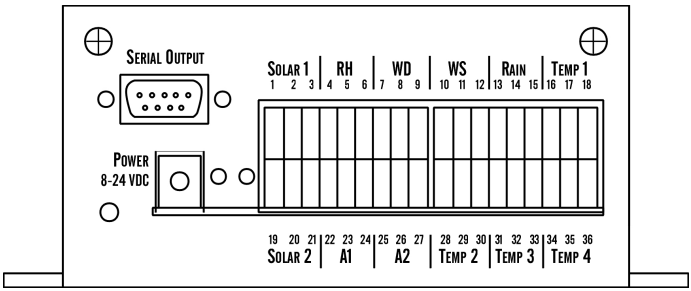
The Control Module can also be housed in a weatherproof enclosure along with an internal power supply and an optional wireless transceiver or a MicroServer.

Technical Specifications:

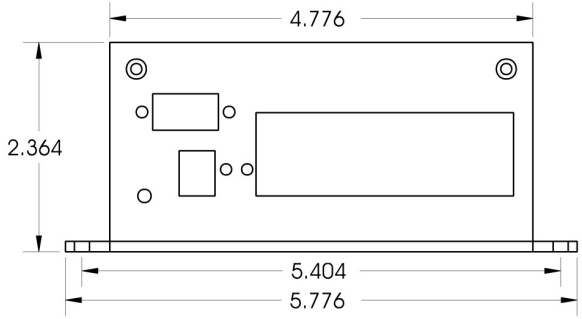
Current Consumption: 10mA @ 12VDC

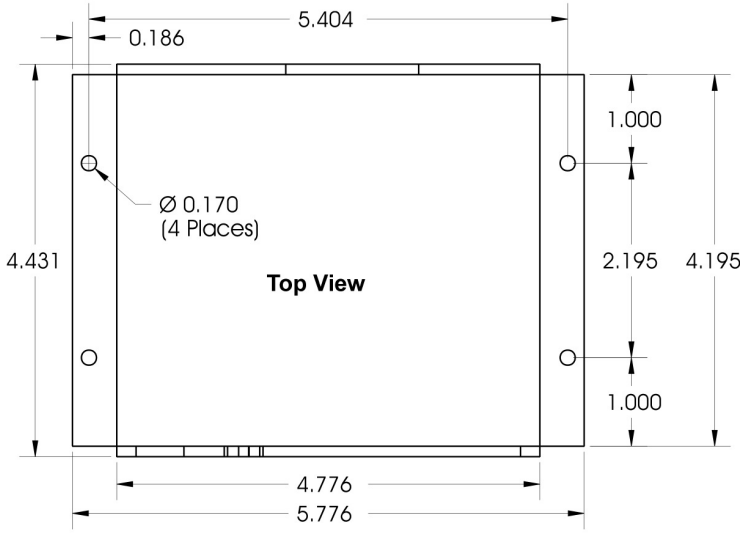
Dimensions: 5.8" L x 4.5" W x 2.4" H

Weight: 0.4lbs



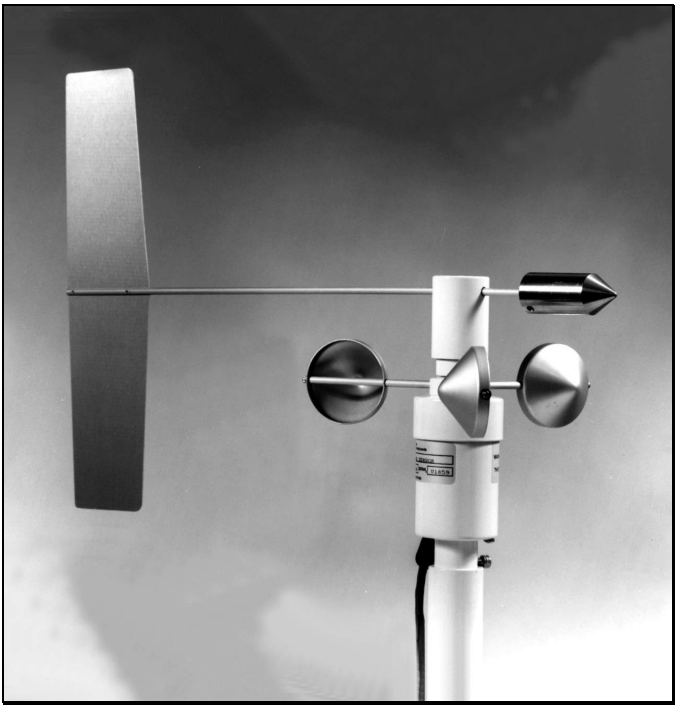
Front View





Dimensions in Inches

Wind Sensor



Note: Please refer to the Met One 034B wind sensor user manual for detailed installation, calibration and maintenance information

The Model 034B Wind Sensor combines wind speed and direction measurements into a single sensing unit.
The 034B Wind Sensor installs in minutes and will provide accurate, long term, continuous monitoring in hostile environments.

Features

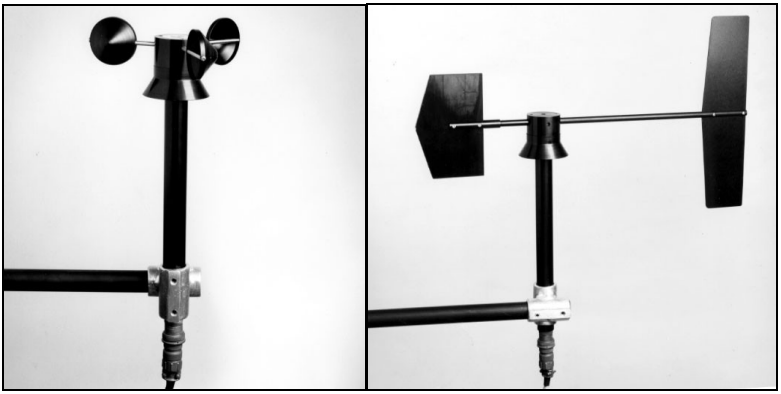
- Wind speed and direction in a single sensor
- Long field life
- Durable aluminum and stainless steel construction
- Low starting threshold
- Stainless steel bearings
- Ultra low power operation
- Easy maintenance

Wind sensor components

The wind sensor consists of four parts:

1. Sensor body
2. Vane
3. Alignment adapter
4. 50 feet of Cable with quick disconnect

Wind Sensor (Heavy Duty)



Note: Please refer to the Met One 013A and 023A sensor user manuals for detailed installation, calibration and maintenance information.

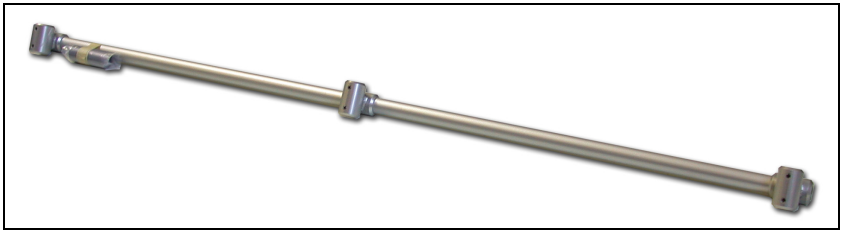
Model 023 Wind Direction Sensor and Model 013A Wind Speed Sensor are rugged sensors that accurately and reliably measure wind speed and direction under the most adverse environmental conditions.

Wind Sensor components

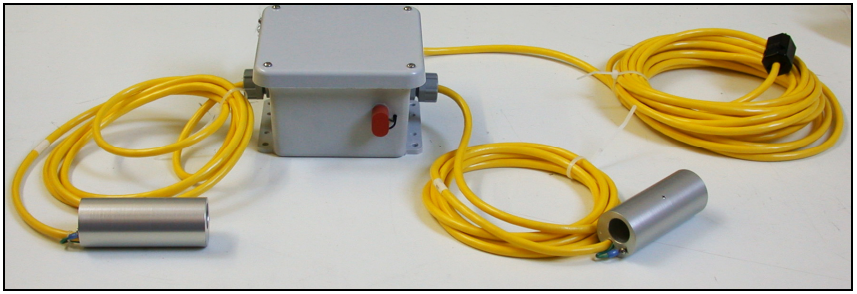
The wind sensor consists of four parts:

1. Wind Speed Sensor
2. Wind Direction Vane
3. Cross arm
4. (2) Two 10 meter sensor cables with quick disconnect connectors
5. Heater (Optional)

Heavy Duty Wind Sensor Cross arm



Heavy Duty Wind Sensor Heater Assembly



Technical Specifications:

013 Wind Speed Sensor

Range: 0 - 150 mph (67 m/s)

Starting Threshold: 1.0 mph (0.45 m/s)

Accuracy: ±0.25 mph (0.11 m/s) or 2%

Operating Range: -50°C to +70°C (-58°F to +158°F)

Weight: 14 oz (.4 kg)

Finish: Black anodized aluminum

023 Wind Direction Sensor

Range: 0° - 360°

Accuracy: ±10° standard

Operating Range: -58°F to +158°F (-50°C to +70°C)

Weight: 1.5 lbs (.68 kg)

Finish: Black anodized aluminum

Temperature Sensor

The Capricorn FLX includes one temperature sensor with 50 feet of cable and a quick disconnect connector pair. Up to four temperature sensors can be connected to the control module.

Relative Humidity Sensor

This optional capacitive relative humidity sensor is compact and easy to use. It can be easily installed in a self-aspirating radiation shield for protection from the sun and rain. This sensor offers long-term stability with minimal drift. Because the sensor is a capacitive device, it will not be affected by surface contamination in unclean environments. The sensor element is socketed and laser trimmed to allow for replacement in the field without additional calibration. The relative humidity sensor comes with a standard 50-foot cable and a quick disconnect connector pair.

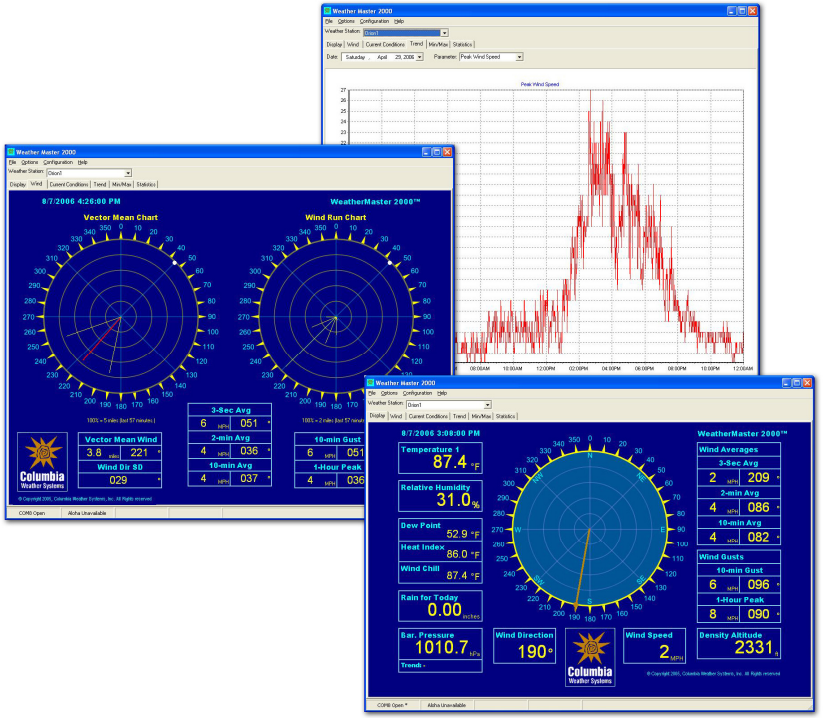
Rain Gauge (Optional)

The optional tipping bucket rain gauge is composed of a complex spun collector funnel with a knife-edge that diverts the water to a tipping bucket mechanism. Each tip causes a momentary closure of a switch to incrementally measure rainfall accumulation. The rainfall sensor is completely automatic - spent water drains out of the bottom of the housing; hence, the instrument requires no servicing. The rain gauge comes with a standard 50-foot cable and a quick disconnect connector pair.

Solar Radiation Sensor - Pyranometer (Optional)

The Pyranometer is designed for routine measurement of global hemispherical solar radiation under all weather conditions. The sensor has a rugged uni-body design, which houses a high performance silicon photodiode detector mounted beneath a conical shaped (self-cleaning) diffuser. Due to the unique diffuser design, the sensitivity of this sensor is proportional to the cosine of incidence of the incoming solar irradiance, allowing for accurate and consistent measurement. The solar radiation sensor comes with a standard 50-foot cable, a quick disconnect connector pair and a leveling plate for obtaining more accurate measurements.

WeatherMaster™ Software (Optional)



WeatherMaster is professional grade weather monitoring software designed for specialized markets that require robust weather calculations, interoperability with computer models, and data interfaces to other industrial systems. WeatherMaster utilizes Microsoft Access database for easy data access and manipulation.

Please refer to the WeatherMaster user manual for installation and operation procedures.

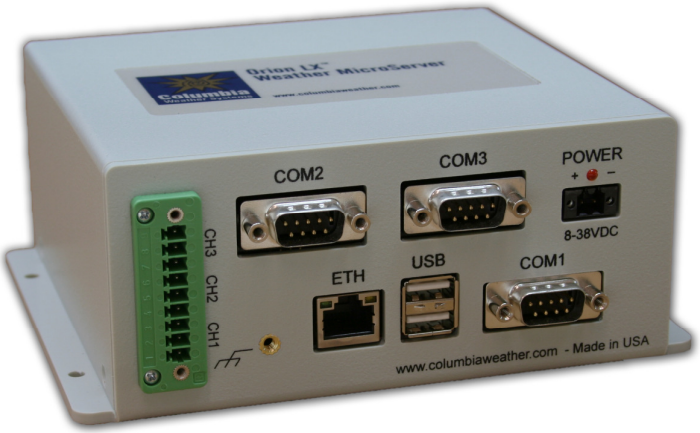
Weather MicroServer™ (Optional)

The Capricorn FLX Control Module connects to the MicroServer via COM1.

The Weather MicroServer uses a small computer board that runs an embedded Linux operating system.

The MicroServer has 32MB flash memory for operation and 8 GB SD card for data logging.

The MicroServer has two RS-232 COM ports and an Ethernet port.



The MicroServer offers the following:

- XML Weather Data
- FTP weather data in XML or CSV format
- Modbus/TCP, Modbus RTU (Serial RS-485), and Modbus ASCII interfaces
- SNMP interface, DNP3 Interface
- Weather Underground & Anything Weather interface
- CWOP interface
- Three months of data logging at 1-minute interval
- Interface to optional visibility, solar radiation sensors, and temperature sensors

Please refer to the Weather MicroServer user manual for more information.

Weather Display Console (Optional)

Displays weather information • Designed to be viewed clearly from a distance • Industrial grade WVGA touchscreen.

Seven-inch, TFT color LCD panel with 800 x 480 pixel resolution.

Performs computations for wind chill, heat index and other calculated parameters • 200MHz ARM9 CPU

Serial or Ethernet connection: Connects directly to weather station with serial port or connects to a Weather MicroServer™ over a network utilizing an existing Ethernet infrastructure. The MicroServer configuration also allows for data from one weather station to be monitored from multiple display consoles at various locations.

Screens can be factory-customized to meet specialized market and industry requirements.

The Weather Display is also available in a 19” rack-mount chassis and a panel-mount configuration.

Please refer to the Weather Display Console user manual for more information.

SECTION 3: INSTALLATION

Wiring and Color Code

Terminal #	Wire Color	Description
Solar Radiation 1		
1	RED	+3.3V
2	BARE	Ground
3	BLACK	Solar Signal
Relative Humidity		
4	RED	+12V
5	BARE	Ground
6	BLACK	Humidity Signal
Wind Direction (Standard)		
7	WHITE	Reference Voltage
8	GREEN	Ground
9	BROWN	Wind Direction Signal
Wind Speed (Standard) (same cable as wind direction)		
10	N/C	No Connection
11	BLACK	Ground
12	RED	Wind Speed Signal
Wind Direction (Heavy Duty)		
7	RED	Reference Voltage
8	BLACK	Ground
9	CLEAR	Wind Direction Signal
Wind Speed (Heavy Duty)		
10	N/C	No Connection
11	BLACK	Ground
12	RED	Wind Speed Signal
Rainfall		
13	N/C	No Connection
14	RED	Rain Signal
15	BLACK	Ground
Temperature 1		
16	RED	+3.3V
17	BARE	Ground
18	BLACK	Temperature 1 Signal
Solar Radiation 2		
19	RED	+3.3V
20	BARE	Ground
21	BLACK	Solar Signal

Analog Sensor 1		
22	RED	+3.3V
23	BARE	Ground
24	BLACK	Signal
Analog Sensor 2		
25	RED	+3.3V
26	BARE	Ground
27	BLACK	Signal
Temperature 2		
28	RED	+3.3V
29	BARE	Ground
30	BLACK	Temperature 2 Signal
Temperature 3		
31	RED	+3.3V
32	BARE	Ground
33	BLACK	Temperature 3 Signal
Temperature 4		
34	RED	+3.3V
35	BARE	Ground
36	BLACK	Temperature 4 Signal

Installation Overview

Unpacking the Unit

Installing the Control Module

Installing the Mast

Routing the Sensor Cables

Installing the Barometric Pressure Sensor

Installing the Temperature & Relative Humidity Sensors

Installing the Wind Sensor

Installing the Optional Rain Gauge Sensor

Installing the Optional Solar Radiation Sensor

Unpacking the Unit

Unpack the Capricorn FLX weather station and verify that all parts are included.

Inspect all system components for obvious shipping damage (Refer to page 5 in case of damage).

Save the shipping carton and packing material in case the unit needs to be returned to the factory. Note: If items are missing or if there is damage, see page 5. If the system does not operate or calibrate properly, see Section 10: Maintenance and Section 11: Troubleshooting, for further instructions.

Unpack the Capricorn FLX weather station and verify that all parts are included.

1. Standard system includes:

- ❑ Control Module
- ❑ (12) 3-position terminal blocks
- ❑ Power Supply
- ❑ Temperature Sensor with 50ft cable
- ❑ Relative Humidity Sensor with 50ft cable
- ❑ Self-Aspirating Radiation Shield for Temp & RH Sensors
- ❑ Wind Speed and Direction Sensor with 50ft cable
- ❑ 6-foot RS-232 cable + additional cable length if ordered
- ❑ User Manual

- ❑ Optional Tipping Bucket Rain Gauge
- ❑ Optional Solar Radiation Sensor

2. WeatherMaster software and user manual **(Optional)**

3. Weather MicroServer **(Optional)**

- ❑ MicroServer
- ❑ Power supply
- ❑ 7-foot Ethernet cable
- ❑ User manual

4. Weather Display Console **(Optional)**

- ❑ Display Console
- ❑ Power supply
- ❑ 6-foot RS-232 cable + additional cable length if ordered
- ❑ User manual

Installing the Control Module

Place the Capricorn FLX Control Module in a clean, dry location.

After powering the control module connect the Chassis Ground terminal to a good earth ground.

Note: It is strongly recommended that you protect your unit from power line spikes (caused by lightning or electrical discharge) by installing a high quality spike-surge suppression device between the Control Module and the power source.

Installing the Mast

There are three methods for mounting the mast to a roof or building structure: Sloped roof mounting, flat roof mounting or wall mounting. See Section 4: Optional Sensor Mounting Hardware for more information.

Routing the Sensor Cables

Use plastic tie wraps to secure the sensor cables to the mast, particularly at the mast base. Tighten the tie wraps securely and clip off any excess length with a wire cutter tool.

Once the sensors have been placed, route the cable back to the Control Module or weatherproof enclosure.

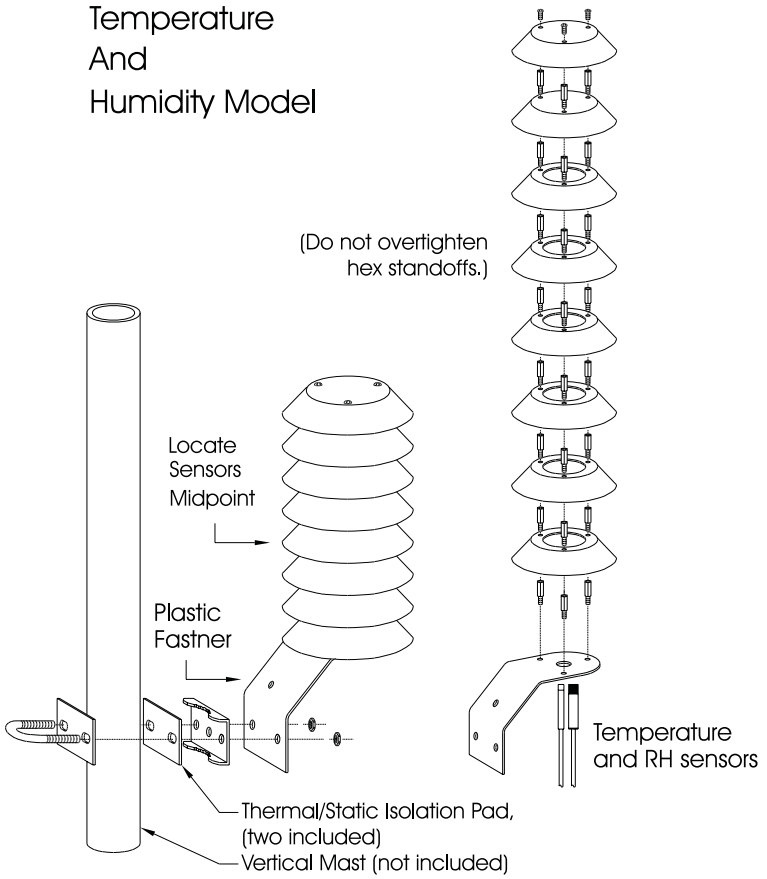
Any mast or tower should always be properly earth grounded to minimize electrical storm damage. The use of a properly grounded metal mast or

tower, however, does not insure protection from electrostatic discharge. These items could become electrically charged resulting in damage to the sensors and/or console. This could damage the system in the event of an electrical storm.

Barometric Pressure Sensor Settings

The barometric pressure sensor is located inside the Control Module; no user installation is required. Please refer to Section 9: Calibration, for the procedure to set the altitude.

Installing the Temperature and Humidity Sensors



The temperature and relative humidity sensors should be mounted in a sheltered area, preferably on the north side of a building.

Insert both humidity and temperature sensors in the radiation shield to the midway point and secure both cables to the plastic fastener on the mounting bracket using the provided tie wrap.

Both sensors are supplied with a standard 50-foot cable. The cable provided is a 22 gauge, 2 conductor shielded cable with a ground drain lead.

Once the sensors have been placed, route the cables back to the Control Module.

Using a small straight screw driver, attach the wires from the end of the temperature cable to the Temperature 1 terminal block on the Control Module as follows:

Red Wire - Terminal #16

Bare Wire - Terminal #17

Black Wire - Terminal #18

Using a small straight screw driver, attach the humidity cable to the RH terminal block on the Control Module as follows:

Red Wire - Terminal #4

Bare Wire - Terminal #5

Black Wire - Terminal #6

Installing Additional Temperature Sensors

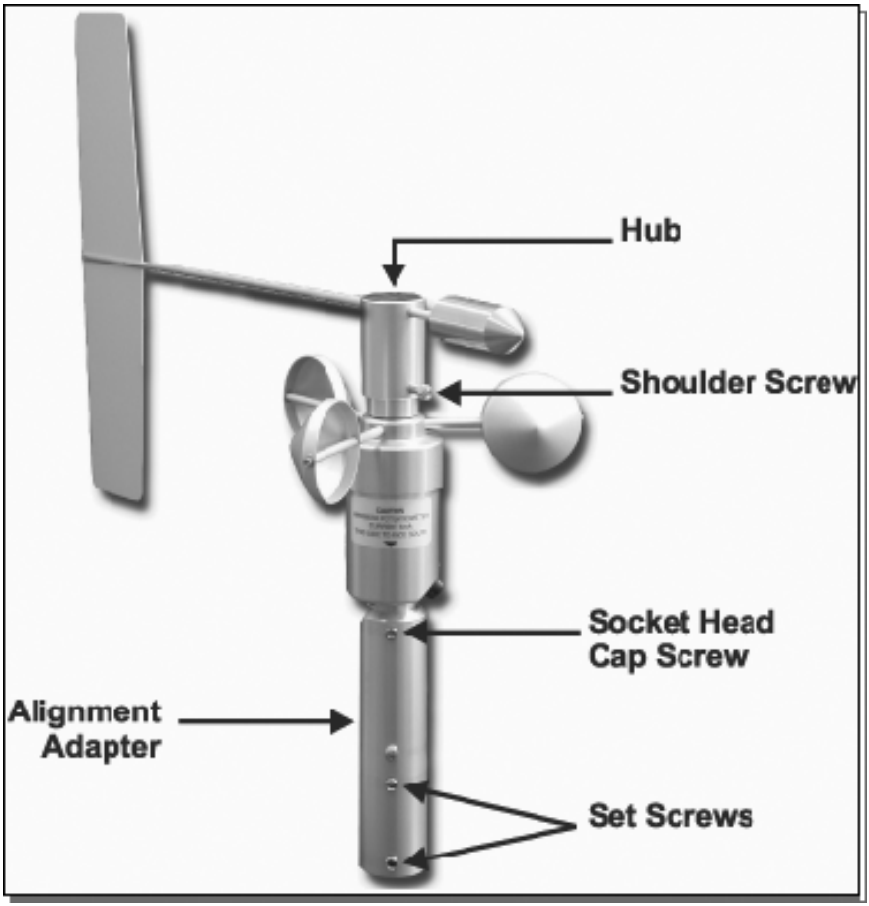
The standard model is supplied with only one temperature sensor. However, additional sensors can be added at any time (Part No. 82100). The Capricorn FLX can accept up to four temperature sensors.

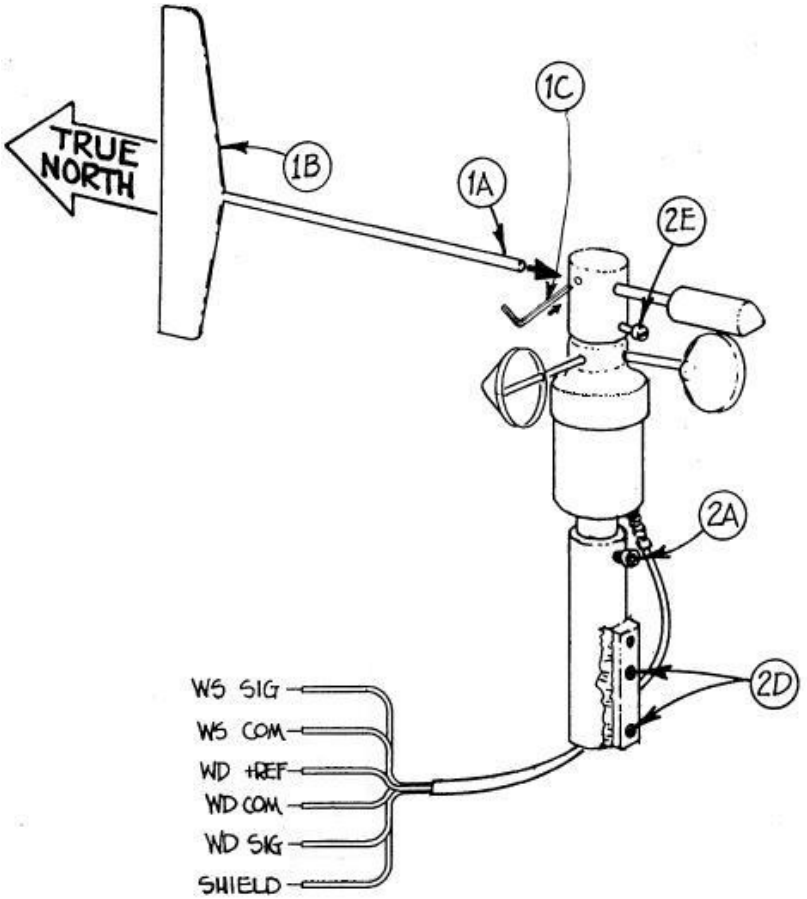
By default the Temperature channel outputs a reading of 255°F with no sensor connected to the terminal.

Installing the Wind Sensor

Assembling the Wind Speed Sensor

Note: Please refer to the Met One 034B wind sensor user manual for detailed installation, calibration and maintenance information. Please read these instructions carefully to insure a safe and reliable installation.


Hub
Shoulder Screw
Socket Head
Cap Screw
Alignment
Adapter
Set Screws



1. Install Vane
   A. Fully insert vane arm into hub
   B. Align vane with center axis of sensor
   C. Using 7/64” Allen wrench, tighten set screw thru top of hub
2. Sensor Installation
   A. Install alignment adapter onto sensor base with socket head cap screw
   B. Place sensor with adapter on tip of mast
   C. Rotate entire sensor until vane tail points to “true North”
   D. Tighten both set screws clamping adapter to mast, using 7/32 Allen wrench
   E. Remove shoulder screw from hub and save
      Connect sensor cable

Mounting Method

Choose the appropriate mounting method for the installation and obtain the necessary mounting hardware. Refer to Section 4 for information on available optional sensor mounting hardware and accessories.

Do not mount sensors close to power lines.

Once the Wind Sensor has been mounted, route the cable back to the Control Module

Using a small straight screw driver, attach the wires from the end of the Wind Sensor cable to the Wind Speed & Direction terminal blocks on the Control Module as follows:

Wind Direction:

White Wire - Terminal #7

Green Wire - Terminal #8

Brown Wire - Terminal #9

Wind Speed (same cable as wind direction):

No Connection - Terminal #10

Black Wire - Terminal #11

Red Wire - Terminal #12

Connect the bare wire to the chassis ground terminal on the front panel of the Control Module enclosure.

Installing the Heavy Duty Wind Sensor

Choose the appropriate mounting method for the installation and obtain the necessary mounting hardware. Refer to Section 4 for information on available optional sensor mounting hardware and accessories.

Do not mount sensors close to power lines.

Once the Wind Sensors have been mounted, route the cables back to the Control Module.

Using a small straight screw driver, attach the wires from the end of the Wind Sensor cables to the Wind Speed & Direction terminal blocks on the Control Module as follows:

Wind Direction

7	RED	Reference Voltage
8	BLACK	Ground
9	CLEAR	Wind Direction Signal

Wind Speed

10	N/C	No Connection
11	BLACK	Ground
12	RED	Wind Speed Signal

Connect ground lugs to grounding post on Capricorn FLX Control Module.

Installing the Rain Gauge Sensor

Safety Note: The top rim of the rain gauge sensor is EXTREMELY sharp. Handle the rim with great care.

The rain gauge is supplied with a standard 50-foot, 22 gauge, 2 conductor shielded cable with a ground drain lead.

To obtain an accurate reading, mount the Rain Gauge Sensor in a clear and open area, either surface or mast mounted in a LEVEL position and in a location free from vibration.

When mounting with other sensors on a mast, position the Rain Gauge as the lowest sensor in the vertical stack to avoid drainage on other sensors. Rotate any sensors mounted above the Rain Gauge away to provide an unobstructed rain path

Once the Rain Gauge Sensor is securely mounted, grasp the top gold funnel portion of the Rain Gauge Sensor firmly and lift up. Do Not place any part of your hand on the rim of the Rain Gauge due to the sharp knife edge. Verify that the black tipping bucket is not in a center position and that one end of the bucket is down against the stop. Replace the top gold funnel portion of the Rain Gauge Sensor.

Once the Rain Gauge Sensor has been placed, route the cable back to the Control Module

Using a small straight screwdriver, attach the wires from the end of the rain cable to the Rain terminal block on the Control Module as follows:

No Connection - Terminal #13

Red Wire - Terminal #14

Black Wire - Terminal #15

Installing the Solar Radiation Sensor

The solar radiation sensor should be installed in an area that receives full sunlight throughout the year away from any object that can create a shadow over the sensor.

The sensor should be mounted on a leveled surface. For accurate readings use the provided leveling plate.

Once the solar radiation sensor is mounted, route the cable back to the Control Module.

Using a small straight screwdriver, attach the wires from the end of the solar cable to the Solar 1 terminal block on the Control Module as follows:

Red Wire - Terminal #1

Bare Wire - Terminal #2

Black Wire - Terminal #3

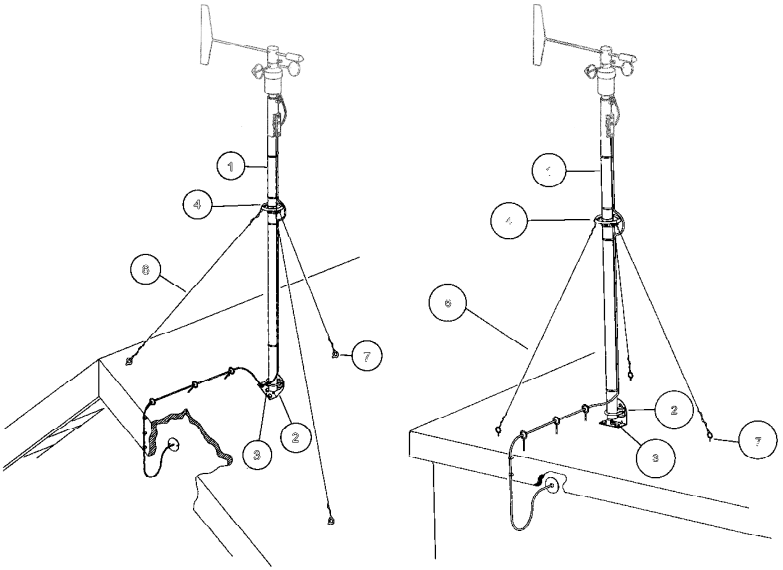
SECTION 4: OPTIONAL SENSOR MOUNTING HARDWARE

Sensor Mast

10-foot steel mast available for use with Roof Mount Hardware Kit (Part No. 88002) or Wall Mount Kit (Part No. 88003).

Roof Mounting

The Roof Mounting Kit (Part No. 88002) is suitable for both a slanted and flat roof installation. The figure and table below illustrates and describes the individual parts.

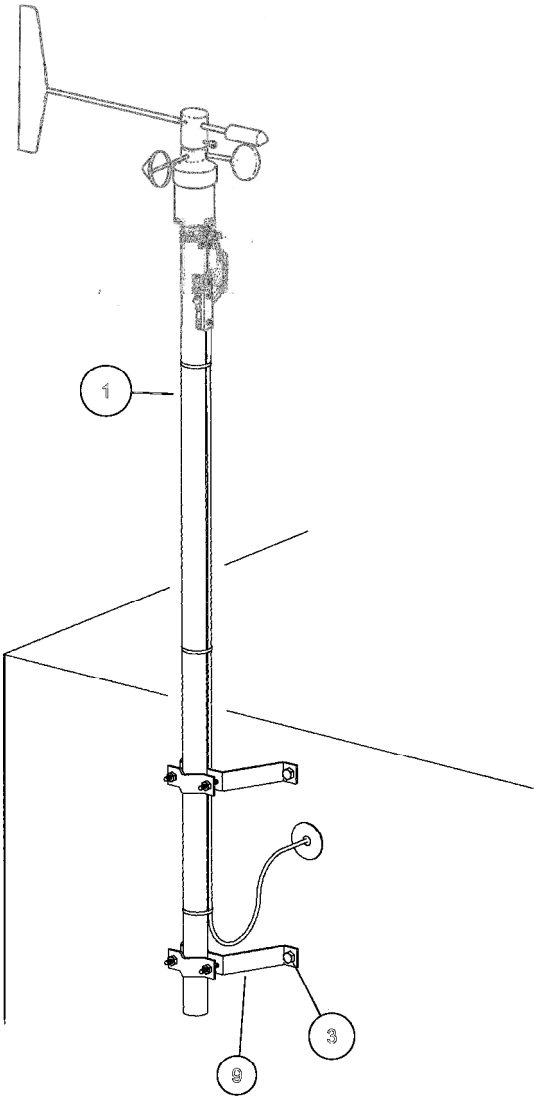


Description	Ref.	Qty.	Part No.
Steel mast, 10 ft.	1	1	88005
Universal Mast Anchor	2	1	88010

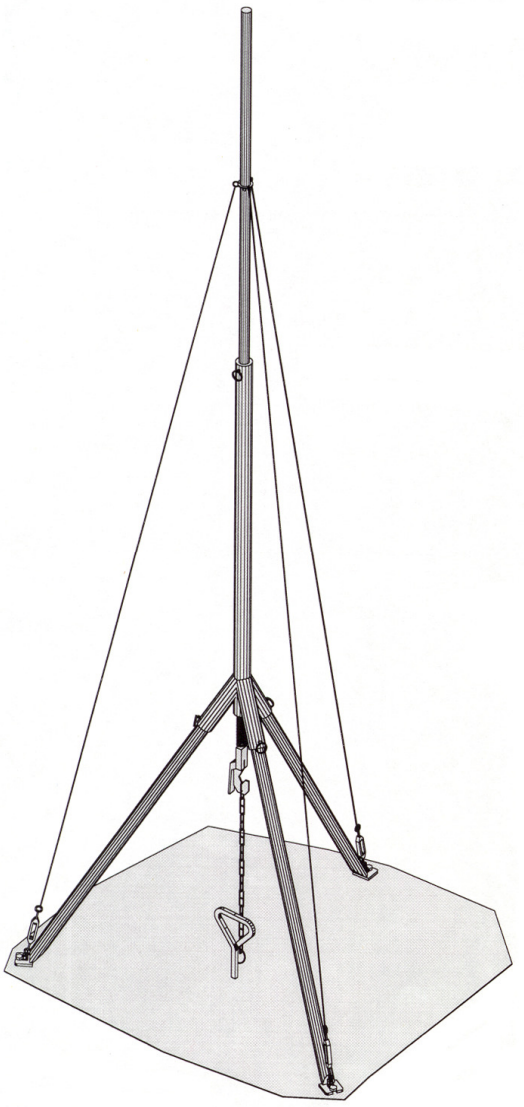
Lag Screw, Roof Mast Mount 1/4" x 2 1/4" (for comp. roofs)	3	4	88030
Guy Wire Clamp, 1/8"	4	1	88070
Steel Guy Wire, Galvanized	6	50ft.	88080
Eye Bolt Wood Screws, 1/4" x 3"	7	4	88090
Turnbuckles, 6" open x 4" closed	(not shown)	3	88100

Wall Mounting

The figure and table below illustrates and describes the individual parts in the Wall Mounting Kit (Part No. 88003). Individual parts are also available.



Telescoping Tripod and Tiedown Kit

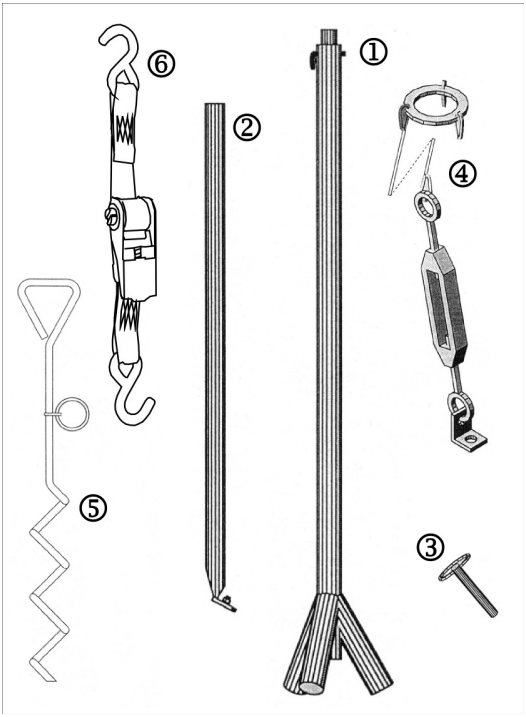


The tripod is designed to provide up to 10 feet of stable, secure support for your meteorological sensors.

Constructed from welded anodized aluminum for appearance and longevity, the 15-pound tripod can easily support up to 60 pounds of equipment. An optional tie-down kit allows for additional security in high-wind areas.

To install, insert the legs into the main body, secure with stainless steel retainer pins. Extend the mast to the desired height, insert another retainer pin and install the guy wires to complete the set-up.

Tripod Parts List:



Description	Ref.	Qty.
Body/Mast Assembly	1	1
Legs	2	3
Retainer Pins	3	4
Guy Wire Ring with 3 Wires and Turnbuckles	4	1
Anchor Screw with Chain	5	1
Clamp with Strap	6	1

Specifications

Capacity: Supports up to 60 lbs.

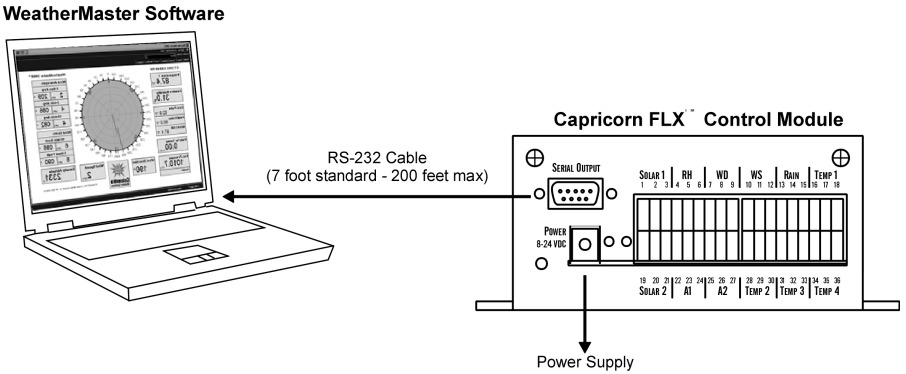
Shipping Weight: 17 lbs.

Shipping Box Dimensions: 71" x 9" x 9"

Tripod and Tiedown Kit Catalog Number: 88019

SECTION 5: OPERATION

Connecting the Control Module to a Computer



Connect the provided RS-232 cable and DB-9 connector (female) to the serial port on the Control Module, securing it with the attached screws.

Connect the other end of the RS-232 cable and DB-9 connector to an available serial port on the computer.

A serial to USB converter may be required if the computer or laptop does not have a serial port installed.

Operating software

Once an RS-232 connection is established between the computer and the weather station, WeatherMaster (optional) can be used to view the data.

A "Terminal" program such as PuTTY or HyperTerminal can also be used to view the data.

Communication Settings

The protocol for both serial ports is the following:

Bits per Second (baud rate): 9600

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

RS-232 Output

The Capricorn FLX outputs the weather data over an RS-232 serial connection.

Once the Control Module is properly connected to a terminal program a record will be displayed once per second.

The wind speed and direction measurements update once every second.

All other measurements including temperature, relative humidity, barometric pressure, rainfall, solar, and analog readings update once every 10 seconds.

The following are examples of the weather data output:

0Cap,0003,Dm=283D,Sm=0.0S,Ua=45P,Pa=29.867I,TA=70.7F,TB=255.0F,TC=255.0F,TD=255.0F,Rc=0.00I,AA=0.244V,AB=0.592V,AC=0.591V,AD=0.634V,Dof

"0003" indicates new wind speed and direction measurements

0Cap,FFFF,Dm=282D,Sm=0.0S,Ua=46P,Pa=29.867I,TA=70.7F,TB=255.0F,TC=255.0F,TD=255.0F,Rc=0.00I,AA=0.328V,AB=0.592V,AC=0.591V,AD=0.622V,B`z

"FFFF" indicates new measurements for all parameters.

Fields Definition:

Dm = Wind Direction (°)

Sm = Wind Speed (mph)

Ua = Relative Humidity (%RH)

Pa = Barometric Pressure (InHg)

TA = Temperature 1 (°F)

TB = Temperature 2 (°F)

TC = Temperature 3 (°F)

TD = Temperature 4 (°F)

Rc = Rainfall (in)

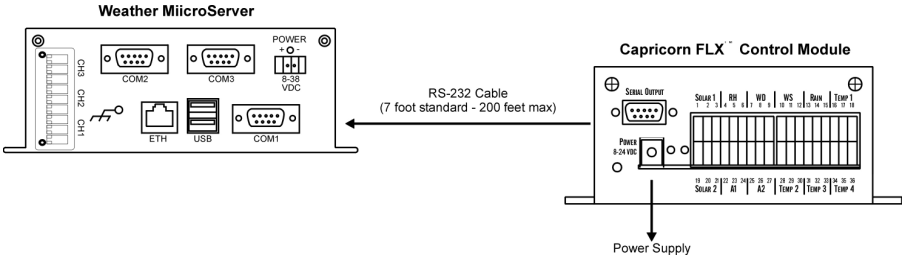
AA = Solar 1 (Volts)

AB = Solar 2 (Volts)

AC = Analog 1 (Volts)

AD = Analog 2 (Volts)

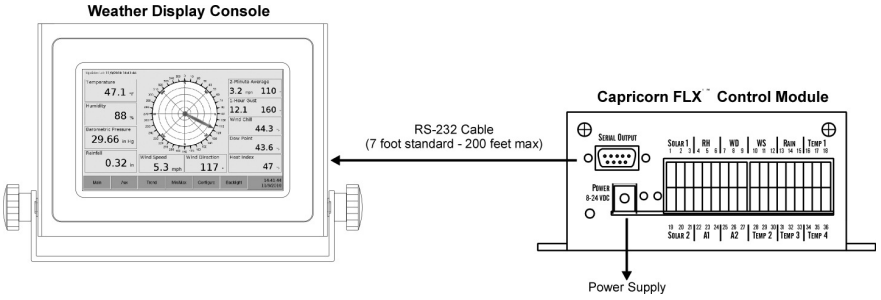
Connecting the Control Module to the Weather MicroServer



Connect the provided RS-232 cable and DB-9 connector (female) to the serial port on the Control Module, securing it with the attached screws.

Connect the other end of the cable and DB-9 connector (male) to COM 1 on the MicroServer, securing it with the attached screws.

Connecting the Control Module to the Weather Display Console

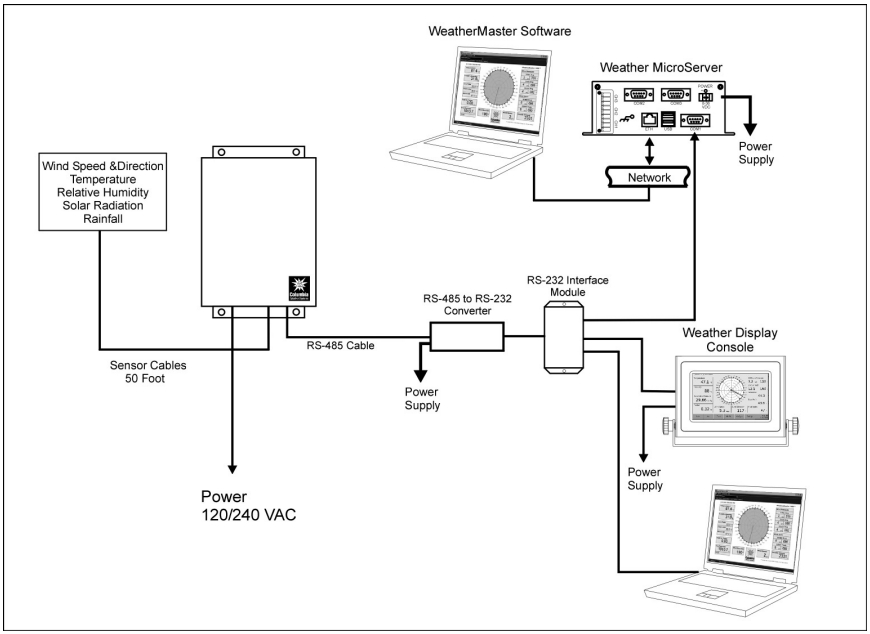


Connect the provided RS-232 cable and DB-9 connector (female) to the serial port on the Control Module, securing it with the attached screws.

Connect the other end of the cable to the serial port (bottom port) on the Weather Display Console.

SECTION 6: OPTIONAL CONFIGURATIONS

RS-485 Configuration



For cable lengths longer than 200ft, the Capricorn FLX can be configured to output the weather data over an RS-485 communication line.

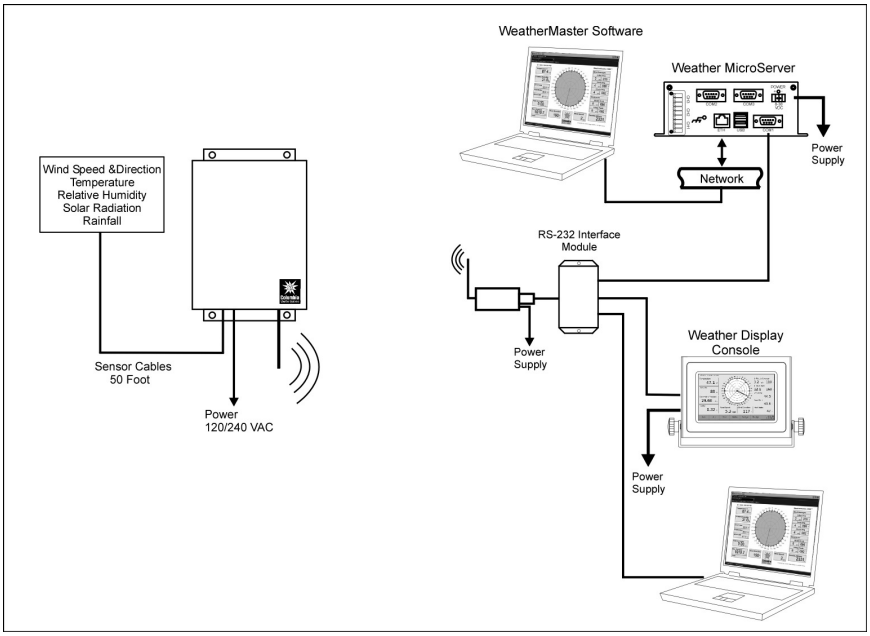
The RS-485 system includes the Control Module, sensors, sensor cables, weatherproof enclosure, power supply and an RS-485 to RS-232 Converter.

The RS-485 signal is converted to RS-232 in order to connect to a monitoring device.

An RS-232 Interface Module is available as an option to connect the weather station to multiple devices.

Refer to Section 3: Installation for instructions to connect the sensors to the Control Module.

Wireless System



The wireless Capricorn FLX Weather Station communicates via a wireless link with monitoring devices such as the MicroServer, Display Console or a computer running WeatherMaster software.

This configuration includes the Control Module, sensors, sensor cables, one pair of wireless transceivers, power supplies and a weatherproof enclosure.

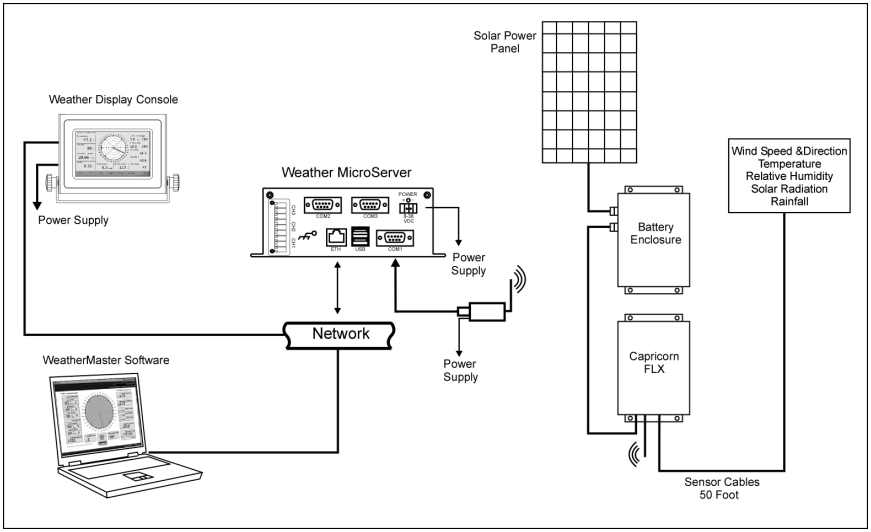
The server transceiver is located near the weather station and is housed in the weatherproof enclosure. A client transceiver is connected to a monitoring device. An optional RS-232 Interface Module is available to connect the wireless transceiver to multiple devices.

The 2.4GHz transceivers are capable of communicating at a distance of 1 mile with a clear line-of-sight.

The 900MHz transceivers are capable of communicating at a distance of 20 miles with a clear line-of-sight.

Refer to Section 3: Installation for instructions to connect the sensors to the Control Module.

Solar Powered System



The Capricorn FLX Control Module is well suited for solar power due to its low power consumption.

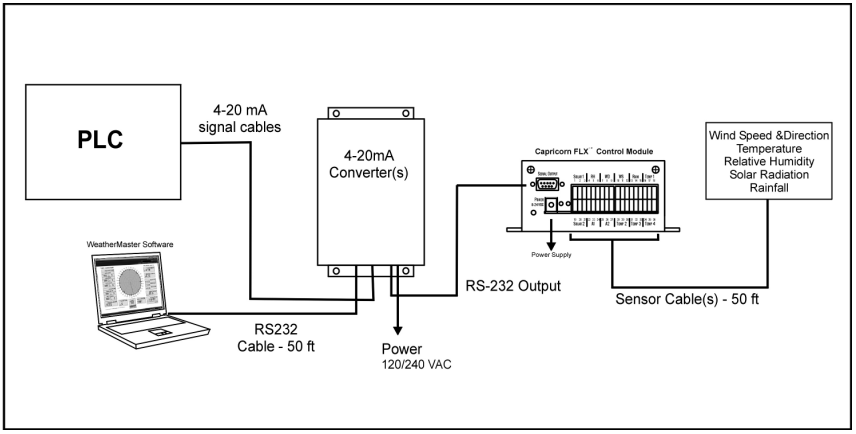
This configuration includes the Control Module, sensors, sensor cables, wireless transceiver, one 12 Volt battery and a 10 Watt solar panel with regulator.

The system includes two weatherproof enclosures; one to house the Control Module and wireless transceiver, the other the 12 Volt battery.

This system connects to optional monitoring devices via a wireless link. The monitoring devices are powered by AC power (120/240VAC).

Refer to Section 3: Installation for instructions to connect the sensors to the Control Module.

Capricorn FLX 420 System



The Capricorn FLX 420 System provides 4-20mA output for industrial interface to PLC, DCS, and SCADA systems.

The station provides eight 4-20mA output channels including wind direction, wind speed, temperature, relative humidity, barometric pressure, rainfall, solar radiation and a reserved channel for an optional sensor.

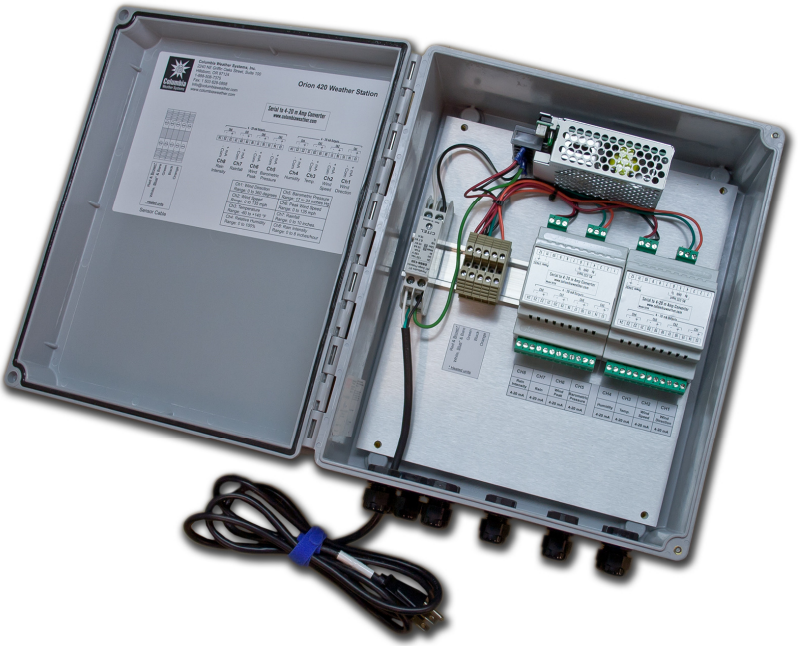
This configuration includes the Control Module, sensors, sensor cables, power supply, surge arrestor and two 4-20mA converter(s) housed in a weatherproof enclosure.

Additional monitoring options, including the Weather Display Console, Weather MicroServer and WeatherMaster software can be connected to the system via an RS-232 cable.

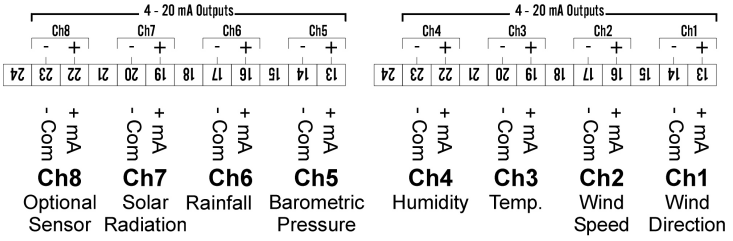
Refer to Section 3: Installation for instructions to connect the sensors to the Control Module.

Note: The 4-20mA converters source power to the load.

420 Weatherproof Enclosure



Serial to 4-20 m Amp Converter
www.columbiaweather.com



Ch1: Wind Direction Range: 0 to 360 degrees	Ch5: Barometric Pressure Range: 14.8 to 32.5 inHg
Ch2: Wind Speed Range: 0 to 160 mph	Ch6: Rainfall Range: 0 to 10 inches
Ch3: Temperature Range: -67 to +257 °F	Ch7: Solar Radiation Range: 0 to 1250 W/m-2
Ch4: Relative Humidity Range: 0 to 100%	Ch8: Optional Sensor Range: See Documentation

The Capricorn FLX 420 outputs the following parameters in 4-20 mA current signals:

Channel 1: Wind Direction

Description: Instantaneous wind direction.

Range: 0 to 360 degrees

Channel 2: Wind Speed

Description: Instantaneous wind speed.

Range: 0 to 160 mph

Channel 3: Temperature

Description: Instantaneous temperature.

Range: -67° to 257°F

Channel 4: Relative Humidity

Description: Instantaneous relative humidity.

Range: 0 to 100%

Channel 5: Barometric Pressure

Description: Instantaneous barometric pressure.

Range: 14.8 to 32.5 inches Hg

Channel 6: Rainfall

Description: 0.01 inches rain accumulation.

Range: 0 to 10.00 inches

The rain accumulates until 10.00 inches is reached at which point the rain will reset to 0.01 inches.

The accumulation measurement will reset to zero when power to the Control Module is lost.

Channel 7: Solar Radiation Sensor

Description: Instantaneous solar radiation.

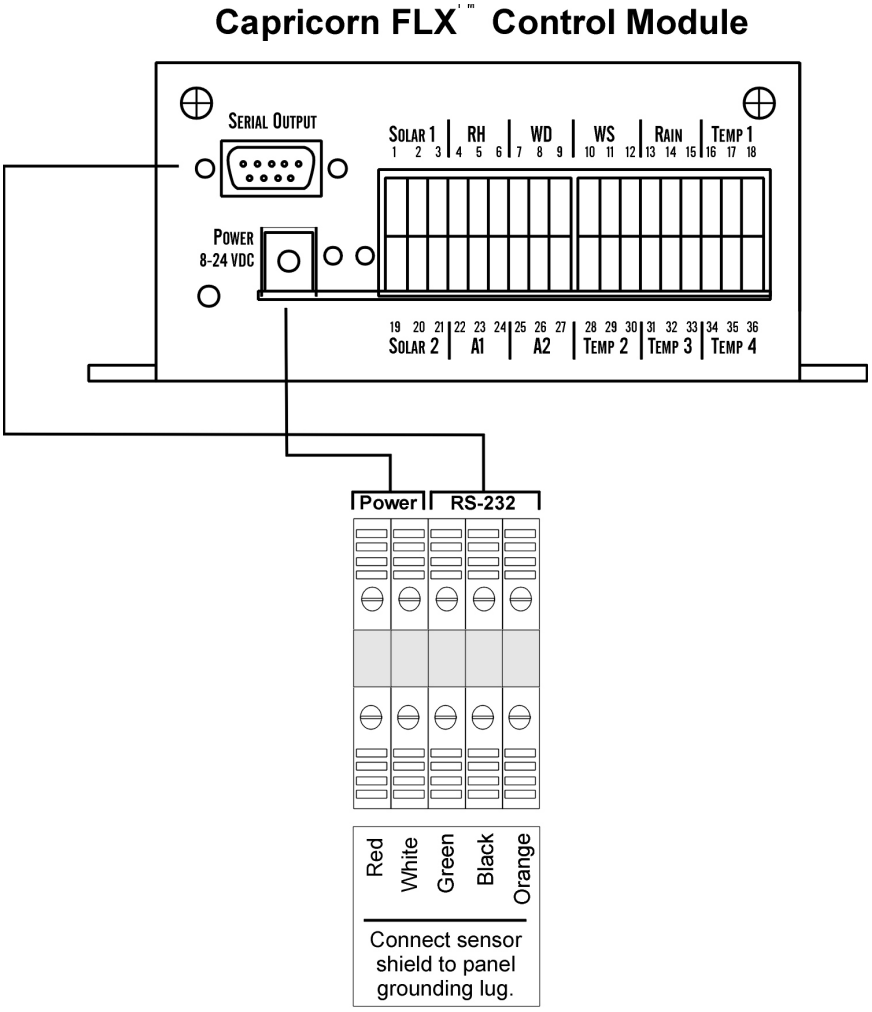
Range: 0 to 1250 W/m-2

Channel 8: Optional Sensor

Range: See Order Documentation

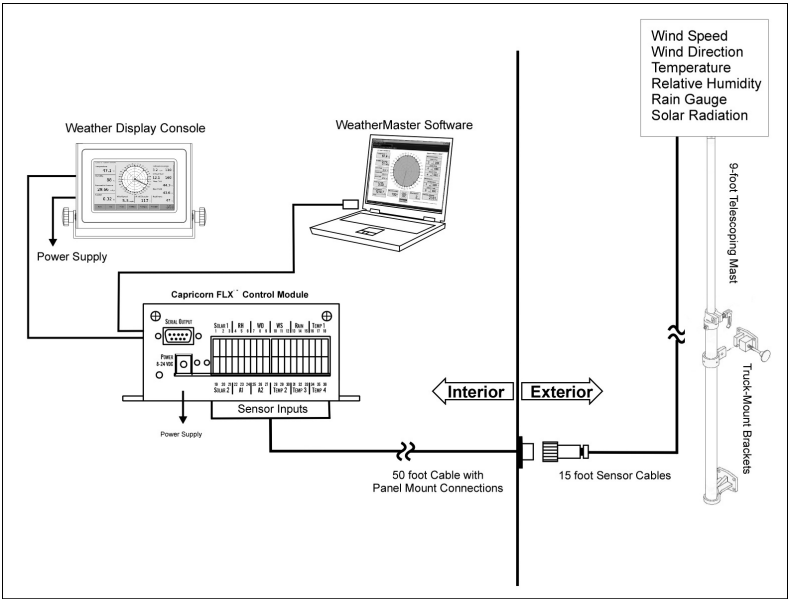
Connecting the Sensor Cable to the Control Module

Using a Straight Slot screwdriver, attach the wires from one end of the sensor cable to the terminal block screws shown below:



Sensor Cable

SECTION 7: VEHICLE MOUNT SYSTEM CONFIGURATION



Installation Overview

Unpacking the Unit

Installing the Connector Plate

Installing the telescoping mast and vehicle-mount brackets

Installing the vehicle mount connector and routing cable

Unpacking the Unit

Unpack the weather station and verify that all parts are included.

Inspect all system components for obvious shipping damage (Refer to “Important Notice: Shipping Damage” in case of damage).

1. Standard system includes:

- ❑ Control Module
- ❑ (12) 3-positon terminal block connectors
- ❑ Power Supply

- ❑ 6-foot RS-232 cable (plus additional cable lengths, if ordered)
- ❑ RS-232 Interface Module (optional)
- ❑ Temperature Sensor with15 ft external sensor cable and male sensor connector (plus additional cable lengths, if ordered)
- ❑ 50 ft internal Temperature Sensor cable with vehicle mount female sensor connector (plus additional cable lengths, if ordered) and all-weather connector cap
- ❑ Wind Sensor with15 ft external sensor cable and male sensor connector (plus additional cable lengths, if ordered)
- ❑ 50 ft internal Wind Sensor cable with vehicle mount female sensor connector (plus additional cable lengths, if ordered) and all-weather connector cap
- ❑ Relative Humidity Sensor with15 ft external sensor cable and male sensor connector (plus additional cable lengths, if ordered)
- ❑ 50 ft internal Relative Humidity Sensor cable with vehicle mount female sensor connector (plus additional cable lengths, if ordered) and all-weather connector cap
- ❑ (Optional) Rain Gauge with with15 ft external sensor cable and male sensor connector (plus additional cable lengths, if ordered)
- ❑ 50 ft internal Rain Gauge Sensor cable with vehicle mount female sensor connector (plus additional cable lengths, if ordered) and all-weather connector cap
- ❑ (Optional) Solar Radiation Sensor with with15 ft external sensor cable and male sensor connector (plus additional cable lengths, if ordered)
- ❑ 50 ft internal Solar Radiation Sensor cable with vehicle mount female sensor connector (plus additional cable lengths, if ordered) and all-weather connector cap
- ❑ Self-Aspirating Radiation Shield for Temperature & Humidity Sensors
- ❑ 9 ft telescoping mast with vehicle-mount brackets
- ❑ Mast extension sleeve adapter
- ❑ Connector Plate
- ❑ User Manual

2. Weather Display Console (**Optional**)

- ❑ Display Console
- ❑ Power supply
- ❑ 6-foot RS-232 cable (plus additional cable lengths, if ordered)
- ❑ User Manual

3. WeatherMaster Software, with User Manual (**Optional**)

Save the shipping carton and packing material in case the unit needs to be returned to the factory. If the system does not operate or calibrate properly, see **Maintenance** and **Troubleshooting** sections, for further instructions.

Installing the Connector Plate

The Connector Plate is mounted on the side of the vehicle and provides an interface between the internal and external sensor cables. The 50ft internal sensor cables run from the Connector Plate to the Control Module inside of the vehicle. The 15ft external sensor cables run from the Connector Plate to the sensors.

The Connector Plate includes insulation gasket and weatherproof connectors for Temperature, Relative Humidity and Wind Sensors.

Weather-tight protective caps for each connector are attached for when the weather station is not in use.

Connector Plate Dimensions: 2.5" x 8.0"

Installing the telescoping mast and vehicle-mount brackets

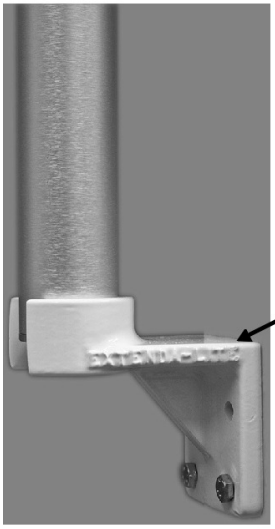
1. Select a location on the vehicle where the mast will be installed.
2. Three mounting brackets are included with the mast. The mounting base plate and a spring-loaded securing mounting bracket will be permanently mounted to the vehicle for quick and easy set up. The third bracket is attached to the mast and mates with a slot on the spring-loaded mounting bracket. This bracket may be loosened and re-positioned on the mast to fit the installation scheme and mounting bracket positioning. A spacer for the spring-loaded bracket is provided to insure that the mast is 90° vertical.
3. Ensure the vehicle-mount sensor connector is in close proximity to the mast's mounting bracket location (refer to the vehicle-mount sensor connector section below). Mark and drill the appropriate mounting bracket holes. Be sure to allow for sufficient structural backing, to adequately support the mast and sensor.
4. External sensor cabling is intended to hang freely along the side of the mast. This assures the mast's easy extension and retraction without pinching, crimping, or cutting the sensor cable. Users may tie-wrap the cable to the lower portion of the mast. The external sensor cable has a male connector that couples to the vehicle-mount female connector on the side of the vehicle.
5. To extend the mast, locate the large textured locking ring at the top of the nested mast. This ring loosens and tightens the mast extension. A counter-clockwise rotation loosens the ring and allows the mast to be fully extended. Clockwise ring rotation tightens the extension in place.

Installing the telescoping mast and vehicle-mount brackets

Spacer
017-0010-006

Spring Loaded
Bracket
017-0010-003

Ring Collar
Bracket
017-0010-002



Base Plate
Bracket
017-0010-004

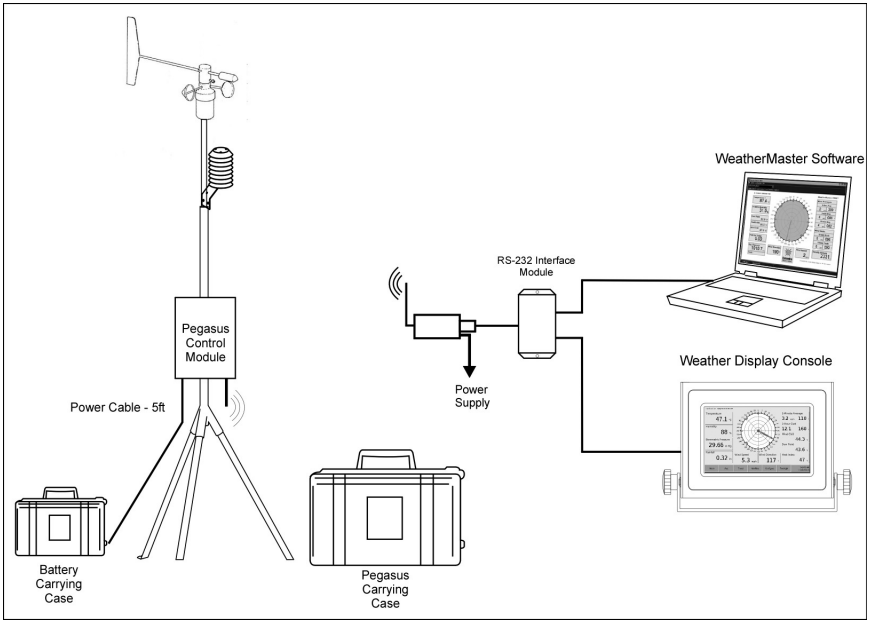
Fully Extended
104.5 inches

Collapsed
60.00 inches

Pull-up pole
017-0010-001

Mast shown in collapsed position

SECTION 8: PEGASUS FLX PORTABLE WEATHER STATION



The Pegasus FLX uses the Capricorn FLX Control Module to provide a complete weather station in a convenient portable system.

The Pegasus transmits weather data wirelessly via a pair of 2.4GHz transceivers to a monitoring option, such as a Weather Display Console or a computer running WeatherMaster software. An optional RS-232 Interface Module is available to connect the wireless transceiver to multiple devices.

The transceivers communicate wirelessly, at a distance of 1 mile with a clear line-of-sight.

Pegasus FLX Control Module

The Control Module and one of the wireless transceivers are contained in a weatherproof chassis that mounts on the tripod. The front panel of the chassis includes connection ports for the sensor cables, transceiver antenna and power.

A small transportation case contains two 12 VDC batteries and is designed to be located at the base of the tripod in order to power the Control Module and transceiver. It is recommended to leave one battery charging while not in use.

A large transportation case is custom designed to store the Control Module, wireless transceiver, Wind Sensor, Temperature Sensor, Relative Humidity Sensor, Self-Aspirating Radiation Shield, sensor cables and (Optional) Display Console.

Installation Overview

Unpacking the Unit

Site Selection

Deploying the Tripod

Mounting the Control Module

Connecting the battery to the Control Module

Connecting the sensors to the Control Module

Unpacking the Unit

Unpack the weather station and verify that all parts are included.

Inspect all system components for obvious shipping damage (Refer to “Important Notice: Shipping Damage” in case of damage).

1. Standard system includes:

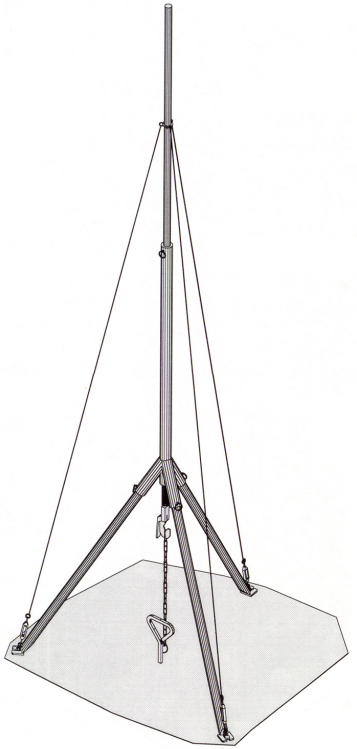
- ❑ Control Module
- ❑ (12) 3-positon terminal block connectors
- ❑ Pair of 2.4GHz wireless transceivers
- ❑ Temperature Sensor with 15ft sensor cable
- ❑ Relative Humidity Sensor with 15ft sensor cable
- ❑ Wind Sensor with 15ft sensor cable
- ❑ Self-Aspirating Radiation Shield for Temperature and Humidity Sensors
- ❑ Battery Power System encased in a small transportation case, with two 12VDC/12AH batteries
- ❑ Battery charger
- ❑ 10ft telescoping tripod sensor mast, tiedown kit, compass and mounting hardware
- ❑ Heavy-Duty canvas tripod transportation bag
- ❑ Large Heavy-Duty polyethylene transportation case
- ❑ User Manual

Site Selection

Site location should be away from trees, buildings or other obstructions that will alter accurate wind direction and speed-readings.

Locate a level area of ground approximately 10ft in diameter to erect the tripod.

Telescoping Tripod and Tiedown Kit

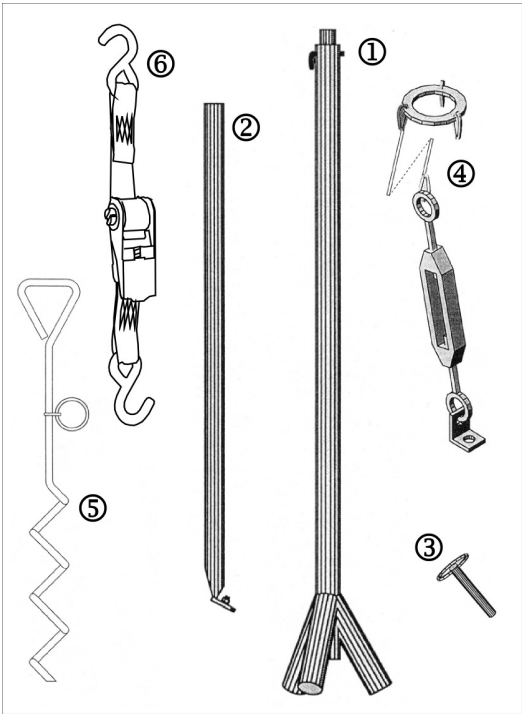


The tripod is designed to provide up to 10 feet of stable, secure support for your meteorological sensors.

Constructed from welded anodized aluminum for appearance and longevity, the 15-pound tripod can easily support up to 60 pounds of equipment. An optional tie-down kit allows for additional security in high-wind areas.

To install, insert the legs into the main body, secure with stainless steel retainer pins. Extend the mast to the desired height, insert another retainer pin and install the guy wires to complete the set-up.

Tripod Parts List:



Description	Ref.	Qty.
Body/Mast Assembly	1	1
Legs	2	3
Retainer Pins	3	4
Guy Wire Ring with 3 Wires and Turnbuckles	4	1
Anchor Screw with Chain	5	1
Clamp with Strap	6	1

Specifications

Capacity: Supports up to 60 lbs.

Shipping Weight: 17 lbs.

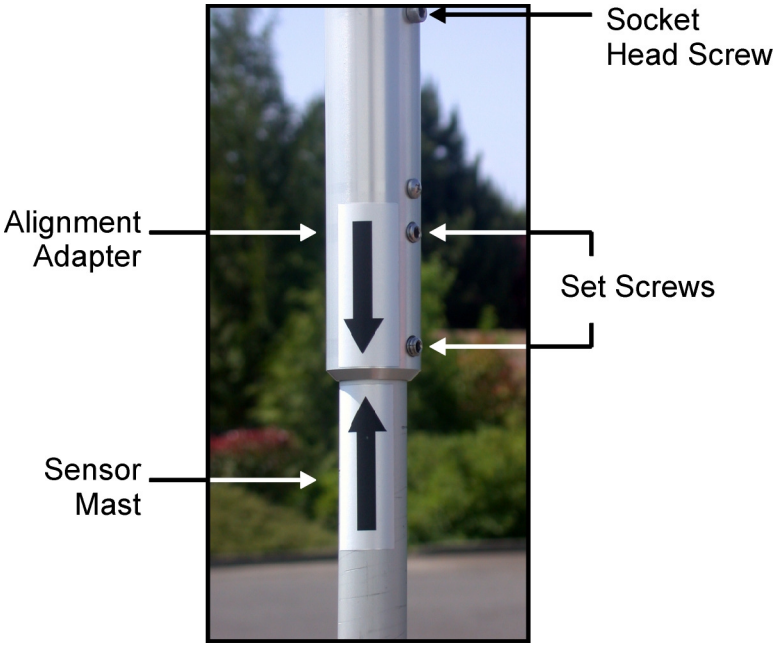
Shipping Box Dimensions: 71" x 9" x 9"

Tripod and Tiedown Kit Catalog Number: 88019

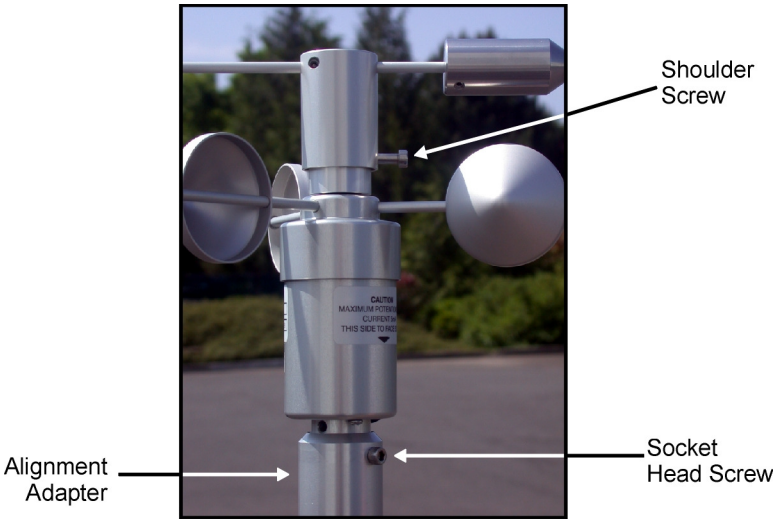
Deploying the Tripod

Please read the complete installation instructions before proceeding.

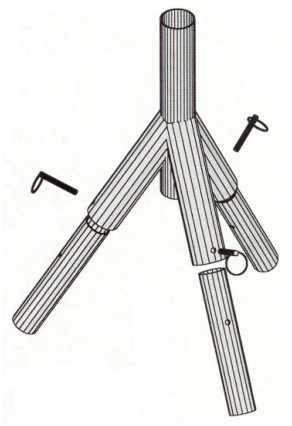
1. Position the tripod base up (without legs) so the sensors may be attached to the mast.
2. Slide the guy wire collar over the sensor mast allowing the guy wires to hang.
3. Install the radiation shield. Do not tighten the nuts at this time.
4. Install the wind sensor assembly on the top of the mast. Align the North mark on the wind sensor alignment adapter to the North mark on the mast and tighten the two set screws using a 5/32” Allen wrench. By removing the socket head screw in the alignment adapter, the sensor may be removed and replaced without realignment.



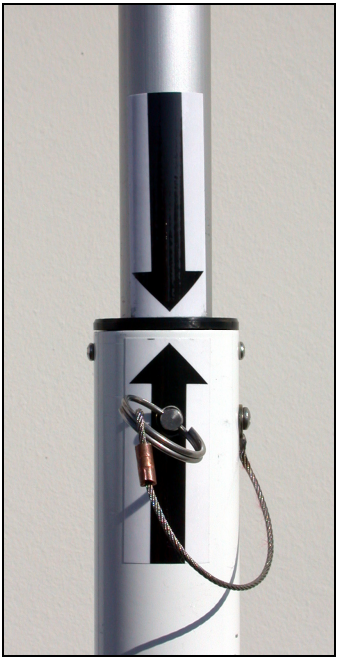
5. Remove and retain the shoulder screw from the vane hub. Check to see that the vane assembly rotates freely.



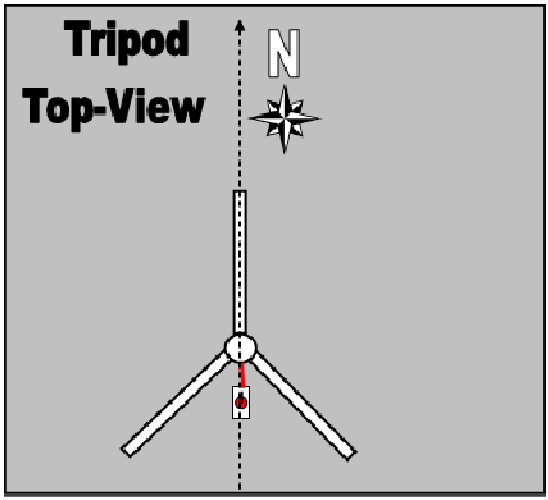
6. Connect the three legs of the tripod using the pins as shown below and attach the guy wires to the feet.



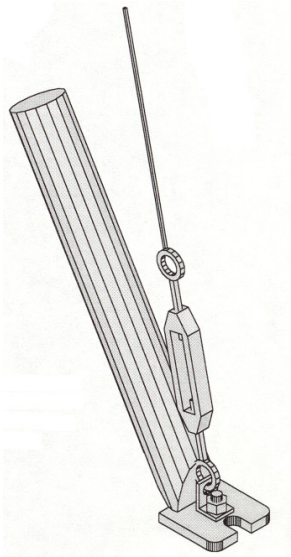
7. Extend the telescoping pole to the full length and secure with the attached pin.



8. Be sure that the North marks on the sensor mast and the tripod body are aligned.

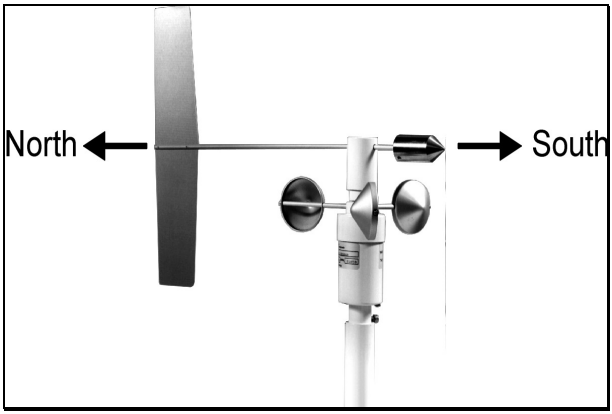


9. Tighten the guy wire turnbuckles so that the sensor mast is aligned vertically.



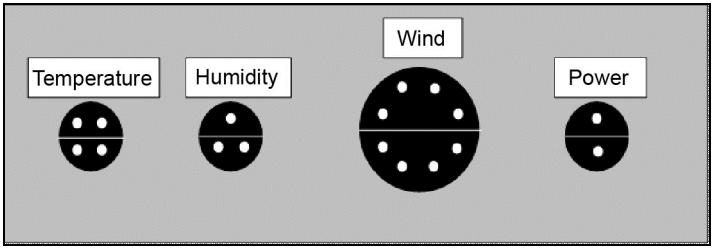
10. Position the radiation shield toward the lower part of the sensor mast extension and tighten using the two nuts.
11. Using the attached compass, orient the entire tripod system to magnetic North as shown below. The tripod leg marked

North should be pointing to North and the wind sensor should be aligned so that the vane is pointing to North (when it is in the locked position).



12. Secure the tripod using the ratchet strap and the corkscrew drilling stake (for soil) or the pavement spike (for hard surfaces). Pavement spikes can be purchased from local hardware stores.
13. Attach the Control Module to the tripod using the mounting adapter.

14. Connect the sensor cables to the Control Module.



15. Place the battery case at the base of the tripod. **Connect the power cable to the battery terminals first and then to the Control Module external connector.**

The system is now operational and is ready to transmit weather data.

SECTION 9: CALIBRATION

Calibrating the Barometric Pressure Sensor

The barometric pressure sensor is calibrated at the factory to a highly accurate digital pressure gauge (±0.02% of full range). No field calibration is required.

Altitude Setting

After calibration at the factory, the altitude is set to zero. To get an accurate barometric pressure reading, the local altitude needs to be set in the weather station. This can be done in any of the available monitoring options including Weather Master Software, the Weather MicroServer and the Weather Display Console.

Note: The barometric pressure sensor is sensitive to changes in elevation of as little as 10 ft. (3 m).

Calibrating the Wind Sensor

General Maintenance schedule:

6-12 month intervals:

A. Inspect the sensor for proper operation per Section 3.0 of the user manual
B. Replacement of wind speed sensor bearing in extremely adverse environments

12-24 month intervals:

A. Replacement of wind speed sensor bearings

24-36 month intervals:

A. Recommended complete factory overhaul of sensor

Note: Please refer to the Met One 034B wind sensor user manual for detailed installation, calibration and maintenance information

Calibrating the Humidity Sensor

The humidity sensor is calibrated at the factory. No field calibration is required.

The humidity sensor has a ±2% stability over 2 years. Therefore we recommend replacing the sensing element every 2 to 4 years.

Calibrating the Rain Gauge Sensor

The rain gauge is calibrated at the factory and does not require any initial field calibration.

The tipping bucket mechanism is a simple and highly reliable device. The transmitter must be located in a clear area, away from trees, buildings, etc. It must also be mounted level. Accurate readings will not be obtained unless the transmitter is mounted in a level position. The mechanism must be clean. Any accumulation of foreign material, dust, etc. will alter the calibration of this unit.

Absolutely accurate calibration can be obtained only with laboratory equipment, but an approximate field check can be easily made.

For field calibration, a calibration kit is available from the factory.

Calibrating the Solar Radiation Sensor

The solar radiation sensor is calibrated at the factory. No field calibration is required.

SECTION 10: MAINTENANCE

In normal use, the Capricorn FLX should require very little maintenance. In the event of any problems, follow the procedures contained in Section 11: Troubleshooting, to determine whether the unit is defective. If the unit needs to be returned to the factory for repair, refer to the Return for Repair Procedure in Section 12: User Support Information.

Console Maintenance

The Control Module contains sensitive electronic components and should not be serviced by the user. If the power LED is not on; check for proper installation of the wall mount power supply.

Barometric Pressure Sensor Maintenance

The barometric pressure sensor is located inside the enclosure and should not be serviced by the user.

Temperature Sensor Maintenance

Check the temperature sensor cables during installation and periodically thereafter to make sure they contain no cuts, kinks or other abnormalities.

Wind Sensor Maintenance

Note: Please refer to the Met One 034B wind sensor user manual for detailed installation, calibration and maintenance information

Relative Humidity Sensor Maintenance

The Relative Humidity sensor does not require any field maintenance.

Rain Gauge Maintenance

Periodically clean the Rain Gauge of any debris that might be clogging the funnel or accumulating in the tipping bucket.

Solar Radiation Sensor Maintenance

Periodically clean the solar radiation sensor lens of any dirt or debris accumulation.

SECTION 11: TROUBLESHOOTING

Wind Sensor (Standard)

The following tests are recommended to help locate the source of faulty wind readings.

Wind Speed Test

1. Disconnect the power supply from the Control Module.
2. Using a small straight blade screwdriver remove the wind sensor wires from their terminals on the Control Module.
3. Reconnect the power supply to the Control Module.
4. Using a 22 gauge jumper wire, connect to terminal #11 and tap the other end on terminal #12. A wind speed reading greater than zero should be displayed.
5. If the wind speed value does not increase from zero, the wind speed channel in the Control Module is defective and should be returned to the factory for repair.
6. If the wind speed value does increase from zero, the wind sensor or the cable is defective. Check the cable for obvious damage. Make sure the cable connector is plugged in the wind sensor correctly and verify the cable connection to the Control Module.
7. If there are no problems with the cable, disconnect the wind sensor and return it to the factory for repair.

Note: Please follow the procedure in Section 12: User Support Information for returning any defective items to the factory.

Wind Direction Test

1. Apply power to the Control Module.
2. Set a mulitmeter to volts DC.
3. Measure the voltage between terminal #7 and #8. Place the black probe on terminal #8 and the red probe on terminal #7. The voltage should be approximately 3.3 volts DC. If the voltage is different, the wind direction channel is defective and the Control Module should be returned to the factory for repair.

4. To continue troubleshooting; place the black probe of the mulitmeter on terminal #8 and the red probe on terminal #9.

5. As the wind vane rotates, the voltage reading will vary from 0 to 3.3 volts DC. If the vane is pointing south, the voltage reading should be 1.65 volts.

6. If the voltage reading is not changing when the vane is rotating or if the value is out of the normal range (0 to 3.3 volts DC) the wind sensor is defective and should be returned to the factory for repair.

Note: Please follow the procedure in Section 12: User Support Information for returning any defective items to the factory.

Temperature Sensor Troubleshooting

If the Temperature sensor is reading 255°F, the Temperature sensor may be disconnected from the Control Module, may not be initialized, or may be defective.

Check the cable from the sensor to the Control Module for any cuts or kinks. Check the cable connection to the Control Module.

The initialization procedure should be performed when replacing or adding a sensor or when a sensor has lost its initialization to the Control Module and is reading 255°F.

To initialize a temperature sensor to the Control Module, perform the following procedure:

1. Disconnect power from the Control Module
2. Connect the Temperature Sensor to the appropriate Temperature Channel on the Control Module
3. Reapply power to the Control Module
4. Verify that the Temperature reading is correct

SECTION 12: USER SUPPORT INFORMATION

This section consists of the following items:

1. One-Year Limited Warranty: Please read this document carefully.
2. Return for Repair Procedure: This procedure is for your convenience in the event you must return your Capricorn FLX for repair or replacement. Follow the packing instructions carefully to protect your instrument in transit.

Limited Warranty

Columbia Weather Systems, Inc. (CWS) warrants the Capricorn FLX Weather Station to be free from defects in materials and/or workmanship when operated in accordance with the manufacturer's operating instructions, for one (1) year from date of purchase, subject to the provisions contained herein. CWS warranty shall extend to the original purchaser only and shall be limited to factory repair or replacement of defective parts.

EXCLUSIONS

Certain parts are not manufactured by CWS (i.e., certain purchased options, etc.) and are therefore not covered by this warranty. These parts may be covered by warranties issued by their respective manufacturers and although CWS will not warrant these parts, CWS will act as agent for the administration of any such independent warranties during the term of this warranty. This warranty does not cover normal maintenance, damage resulting from improper use or repair, or abuse by the operator. Damage caused by lightning or other electrical discharge is specifically excluded. This warranty extends only to repair or replacement, and shall in no event extend to consequential damages. In the event of operator repair or replacement, this warranty shall cover neither the advisability of the repair undertaken, nor the sufficiency of the repair itself.

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This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Return for Repair Procedure

1. In the event of defects or damage to your unit, first call the factory Monday through Friday, 8:30 am to 4:00 pm PST, (503) 629-0887 to determine the advisability of factory repair. The Service Department will issue an RMA number (Return Merchandise Authorization) to help us identify the package when received. Please place that number on the outside of the box.

2. In the event factory service is required, return your Capricorn FLX as follows:

   A. Packing

   - Wrap Control Module in plastic bag first.
   - Pack in original shipping carton or a sturdy oversized carton.
   - Use plenty of packing material.

   B. Include:

   - A brief description of the problem with all known symptoms.
   - Your phone number.
   - Your return street shipping address (UPS will not deliver to a P.O. Box).
   - Write the RMA number on the outside of the box.

   C. Shipping

   - Send freight prepaid (UPS recommended).
   - Insurance is recommended. (The factory can provide the current replacement value of the item being shipped for insurance purposes.)

   D. Send to:

   Columbia Weather Systems, Inc.
   5285 NE Elam Young Parkway, Suite C100
   Hillsboro, Oregon 97124

   E. C.O.D. shipments will not be accepted.

3. If your unit is under warranty, after repair or replacement has been completed, it will be returned by a carrier and method chosen by Columbia Weather, Inc. to any destination within the

continental U.S.A. If you desire some other specific form of conveyance or if you are located beyond these borders, then you must bear the additional cost of return shipment.

4. If your unit is not under warranty, we will call you with an estimate of the charges. If approved, your repaired unit will be returned after all charges, including parts, labor and return shipping and handling, have been paid. If not approved, your unit will be returned as is via UPS COD for the amount of the UPS COD freight charges.

Firmware Licenses and Copyright Information

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Upon request, source code for software licensed under the LGPL is available from Columbia Weather, Inc.

Columbia Weather Systems, Inc.
5285 NE Elam Young Pkwy
Suite C100
Hillsboro, OR 97124
503-629-0887
info@columbiaweather.com

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OneWire

Copyright (c) 2007, Jim Studt (original old version - many contributors since)

The latest version of this library may be found at:
http://www.pjrc.com/teensy/td_libs_OneWire.html

OneWire has been maintained by Paul Stoffregen (paul@pjrc.com) since
January 2010. At the time, it was in need of many bug fixes, but had
been abandoned the original author (Jim Studt). None of the known
contributors were interested in maintaining OneWire. Paul typically
works on OneWire every 6 to 12 months. Patches usually wait that
long. If anyone is interested in more actively maintaining OneWire,
please contact Paul.

Version 2.2:
Teensy 3.0 compatibility, Paul Stoffregen, paul@pjrc.com
Arduino Due compatibility, http://arduino.cc/forum/index.php?topic=141030
Fix DS18B20 example negative temperature
Fix DS18B20 example's low res modes, Ken Butcher
Improve reset timing, Mark Tillotson
Add const qualifiers, Bertrik Sikken
Add initial value input to crc16, Bertrik Sikken
Add target_search() function, Scott Roberts

Version 2.1:
Arduino 1.0 compatibility, Paul Stoffregen
Improve temperature example, Paul Stoffregen
DS250x_PROM example, Guillermo Lovato
PIC32 (chipKit) compatibility, Jason Dangel, dangel.jason AT gmail.com
Improvements from Glenn Trewitt:
- crc16() now works
- check_crc16() does all of calculation/checking work.
- Added read_bytes() and write_bytes(), to reduce tedious loops.
- Added ds2408 example.
Delete very old, out-of-date readme file (info is here)

Version 2.0: Modifications by Paul Stoffregen, January 2010:
http://www.pjrc.com/teensy/td_libs_OneWire.html
Search fix from Robin James
http://www.arduino.cc/cgi-bin/yabb2/YaBB.pl?num=1238032295/27#27
Use direct optimized I/O in all cases
Disable interrupts during timing critical sections
(this solves many random communication errors)
Disable interrupts during read-modify-write I/O
Reduce RAM consumption by eliminating unnecessary
variables and trimming many to 8 bits
Optimize both crc8 - table version moved to flash

Modified to work with larger numbers of devices - avoids loop.
Tested in Arduino 11 alpha with 12 sensors.
26 Sept 2008 -- Robin James
http://www.arduino.cc/cgi-bin/yabb2/YaBB.pl?num=1238032295/27#27

Updated to work with arduino-0008 and to include skip() as of
2007/07/06. --RJL20

Modified to calculate the 8-bit CRC directly, avoiding the need for
the 256-byte lookup table to be loaded in RAM. Tested in arduino-0010
-- Tom Pollard, Jan 23, 2008

Jim Studt's original library was modified by Josh Larios.

Tom Pollard, pollard@alum.mit.edu, contributed around May 20, 2008

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Much of the code was inspired by Derek Yerger's code, though I don't
think much of that remains. In any event that was..
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stdio.h

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$Id: stdio.h,v 1.29.2.1 2008/02/23 08:59:27 dmix Exp $
*/

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END OF TERMS AND CONDITIONS

Reference

Glossary

Aspirating Radiation Shield

A device used to shield a sensor such as a temperature probe from direct and indirect radiation and rain while providing access for ventilation.

Barometric Pressure

The pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the “column” of air lying directly above the point in question.

Celsius Temperature Scale

A temperature scale with the ice point at 0 degrees and the boiling point of water at 100 degrees.

Density Altitude

Density altitude is a meteorological variable that is important to pilots, especially during the summer. The density altitude is the altitude in a standard atmosphere where the density is the same as the given atmospheric density. During a hot muggy summer day, a pilot begins take off from an airport with an elevation of 2500 feet. Because of the warm temperature and the moisture in the air, the airplane has to work as if it was taking off at an airport at an elevation of 6000 feet resulting in the plane needing more power and a longer roll down the runway to take off.

Dew Point

The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapor content in order for saturation to occur. When this temperature is below 0°C, it is sometimes called the frost point.

Fahrenheit Temperature Scale

A temperature scale with the ice point at 32 degrees and the boiling point of water at 212 degrees.

Global Radiation

The total of direct solar radiation and diffused sky radiation received by a unit horizontal surface. Global radiation is measured by a Pyranometer.

Heat Index

The heat index or apparent temperature is a measure of discomfort due to the combination of heat and high humidity. It was developed in 1979 and is based on studies of evaporative skin cooling for combinations of temperature and humidity.

Pyranometer

It measures the combined intensity of incoming direct solar radiation and diffused sky radiation. The Pyranometer consists of a radiation-sensing element, which is mounted so that it views the entire sky.

Relative Humidity

Popularly called humidity. The ratio of the actual vapor pressure of the air to the saturation vapor pressure.

Sea Level Pressure

The atmospheric pressure at mean sea level, either directly measured or, most commonly, empirically determined from the observed station pressure.

In regions where the earth's surface pressure is above sea level, it is standard observational practice to reduce the observed surface pressure to the value that would exist at a point at sea level directly below.

Solar Radiation

The total electromagnetic radiation emitted by the sun. 99% of the suns energy output falls within the wavelength interval from 0.15 microns to 4.0 microns, with peak intensity near 0.47 microns. About one-half of the total energy in the solar beam is contained within the visible spectrum from 0.4 to 0.7 microns, and most of the other half lies near infrared, a small additional portion lying in the ultraviolet.

Wind Chill

That part of the total cooling of a body caused by air motion.

Unit Conversion

Speed

Kilometers per hour = 1.610 x miles per hour

Knots = 0.869 x miles per hour

Meters per second = 0.448 x miles per hour

Feet per second = 1.467 x miles per hour

Temperature

Temperature in °C = 5/9 (temperature in °F - 32)

Temperature in °F = (1.8 x temperature in °C) + 32

Distance

Millimeters = 25.4 x inches

Pressure

Millibars = 33.86 x inches of mercury

Kilopascals = 3.386 x inches of mercury

Pounds per square inch = 0.49 x inches of mercury

Standard atmospheres = 0.0334 x inches of mercury

Solar Radiation

BTU/foot^2 minutes = 0.00529 x watts/meter^2

Joules/centimeter^2 minutes = 0.006 x watts/meter^2

Mega joules/meter^2 day = 11.574 x watts/meter^2

Langleys/minutes = 0.00143 x watts/meter^2

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